

THE GRADUATE SCHOOL

1958 - 1959

# CLEMSON



CLEMSON  
COLLEGE

R E C O R D

ANNOUNCEMENTS OF  
THE GRADUATE SCHOOL  
FOR  
1958-59

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## CHECK LIST ON GRADUATE SCHOOL PROCEDURES

The final responsibility for following Graduate School procedures rests with the graduate students. Special problems should be referred to the Graduate School Office, Room 17, Tillman Hall.

After admission the graduate student should be especially careful to follow this check list:

1. Submit **Plan for Graduate Study** (G. S. Form 2) not later than thirty days from initial registration. (See page 14.)
2. If necessary, submit request for **changes** in Plan for Graduate Study. (See page 14.)
3. Select in consultation with the appropriate Department Head a major advisor and/or an advisory committee. (See page 15.)
4. Satisfy any **prescribed foreign language examination** and other **qualifying** examinations prerequisite to admission to candidacy. (See page 16.)
5. **Apply for candidacy to degree** (G. S. Form 4) after completing at least half the prescribed residence and course work and after passing any prescribed qualifying examinations. (See page 15.)
6. Place **formal order for diploma** with the Registrar and pay **diploma fee** two months ahead of graduation. (See page 17.)
7. Submit **completed thesis** to advisory committee chairman and arrange for **final examination** by the advisory committee. (See page 16.)
8. Submit **abstract** and **approved thesis** to the Dean of the Graduate School and pay **binding fee to the Bursar**. (See page 16.)



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# COLLEGE CALENDAR

## SESSION 1958-59

|   |                  |
|---|------------------|
| Matriculation, new students .....                     | September 11     |
| Registration, new students .....                      | September 15     |
| Matriculation and registration, current students ..   | September 15, 16 |
| Classes begin .....                                   | September 17     |
| Foreign Language Examination .....                    | October 11       |
| State Fair Holidays begin at 12 noon .....            | October 22       |
| Thanksgiving Holidays begin after last class .....    | November 26      |
| Christmas Holidays begin at 12 noon .....             | December 20      |
| Classes resumed .....                                 | January 5        |
| Theses Due in Graduate Office .....                   | January 24       |
| End of first semester .....                           | January 31       |
| Matriculation, new students .....                     | February 2       |
| Registration, new students .....                      | February 4       |
| Matriculation and registration, current students .... | February 5       |
| Classes begin .....                                   | February 6       |
| Easter Holidays begin after last class .....          | March 26         |
| Foreign Language Examination .....                    | April 11         |
| Theses Due in Graduate Office .....                   | May 30           |
| Commencement .....                                    | June 7           |

## PERSONNEL

### ADMINISTRATIVE OFFICERS

Robert Cook Edwards, B.S.  
Acting President

Francis Marion Kinard, A.M., Litt.D.  
Dean of the College

Walter Thompson Cox, B.S.  
Dean of Student Affairs

Melford A. Wilson, B.S.  
Comptroller

Milton Dyer Farrar, Ph.D.  
Dean of Agriculture

Jess Willard Jones, Ph.D.  
Director of Agricultural Teaching

Harlan Ewart McClure, M.A.  
Dean, School of Architecture

Howard Louis Hunter, Ph.D.  
Dean, School of Arts and Sciences

James Hagood Sams, Jr., Ph.D.  
Dean, School of Engineering

Gaston Gage, M.Ed.  
Acting Dean, School of Textiles

Jack Kenny Williams, Ph.D.  
Dean of the Graduate School

John Wallace Gordan Gourlay, A.M.L.S.  
Director of the Library

Kenneth Notley Vickery, B.S.  
Registrar

### GRADUATE COUNCIL

1958-1959

Jack Kenny Williams, Ph.D., Chairman

James Pendleton Brewster, Ph.D.

Jess Willard Jones, Ph.D.\*

James Clinton Cook, Jr., Ph.D.

James Horace Langston, Ph.D.

Gaston Gage, M.Ed.\*

Charles Edward Littlejohn, Ph.D.

Willie Cecil Godley, Ph.D.

Hugh Holleman Macaulay, Jr., Ph.D.

James Harvey Hobson, Ph.D.

James Hagood Sams, Jr., Ph.D.\*

Howard Louis Hunter, Ph.D.\*

Hubert Judson Webb, Ph.D.

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\*Ex officio members of the Graduate Council.

## GENERAL INFORMATION

### INTRODUCTION

Clemson is a land-grant college, a state institution, and one of the A. and M. colleges which emphasizes agriculture and mechanical industries. Clemson is fully accredited by the Southern Association of Colleges and Secondary Schools. The twenty-nine curriculums under the Schools of Agriculture, Architecture, Arts and Sciences, Engineering, and Textiles form a background of training for the hundreds of occupations which Clemson graduates enter.

The government of the College is vested in a Board of Trustees. In accord with the Thomas G. Clemson will the Board includes six members elected by the Legislature and a self-perpetuating group of seven members. The function of the Board is legislative. The Board determines the general policy of the College and directs the expenditure of its funds.

The President of the College is the chief executive and administrative officer.

### THE GRADUATE SCHOOL

The Graduate School exists to formulate policies and standards, and to unify administrative procedures concerning all graduate work at Clemson. The Graduate School is headed by a dean who serves as chairman of the Graduate Council, a policy-making body appointed from the general faculties of the College.

The aims of graduate programs at Clemson are to provide comprehensive training in special fields, to offer instruction in the methods of independent investigation, and to foster the spirit of research scholarship.

### EXPENSES

**Full-time Students.** The 1958-59 tuition and fees for a full-time graduate student are \$129.40 per semester for a South Carolina student and \$229.40 per semester for an out-of-state student. The fees included in these charges are matriculation, laboratory, class



maintenance, medical, and student activity. The thesis binding fee, the diploma fee, and the fee for cap and gown rental are not included. A student living in college dormitories is charged \$140.95 per half-semester for room, board, and laundry.

**Part-time Students.** The 1958-59 tuition costs to part-time graduate students vary according to the amount of work scheduled as follows:

|                                  | S. C. Student | Out-of-State |
|----------------------------------|---------------|--------------|
| 1/4 time student (1-5 credits)   | \$ 28.70      | \$ 53.70     |
| 1/2 time students (6-8 credits)  | 55.90         | 105.90       |
| 3/4 time students (9-11 credits) | 83.10         | 158.10       |

These charges include matriculation, laboratory, and class maintenance fees. Part-time students do not pay medical fees. A part-time student taking six or more credits is given the opportunity at the time of matriculation of paying a \$9.10 student activities fee.

## FINANCIAL AID FOR GRADUATE STUDY

RESEARCH AND TEACHING ASSISTANTSHIPS are available to outstanding graduate students. Teaching assistantships are normally awarded for the academic year while research assistantships may be granted for periods of twelve months. Both are renewable. Stipends range from \$1200 to \$2000. Application forms for assistantships are obtainable from the Dean of the Graduate School or from department heads.

GRADUATE FELLOWSHIPS and GRANTS-IN-AID are also available. Among them are the following:

**The Alexander P. and Lydia Anderson Fellowship** in biological science, including Bacteriology and Entomology.

**The Celanese Fellowship** in Textile Chemistry.

**The Dow Corning Fellowship** in Textile Chemistry.

**The Edward Orton, Jr. Fellowship** in Ceramic Engineering.

**The Foundation for Cotton Research and Education Fellowships** in Ginning Engineering.

**The Godfrey L. Cabot Fellowship** in Ceramic Engineering.

**The Zonolite Fellowship** in Ceramic Engineering.

GRANTS-IN-AID to graduate students are sponsored by the Mead Corporation and by the Laurence S. Barringer Foundation.

### EDUCATIONAL BENEFITS FOR VETERANS

Eligible veterans of the armed services may qualify for financial aid in graduate study. Forms for filing applications for assistance are provided by the Veteran's Administration.

### LIBRARY

The Library Building houses the main Library, the Agricultural Reference Department and the Browsing Room. In addition, several departments of the College maintain departmental libraries in their own buildings.

The main Library collection consists of some 166,248 bound volumes of books, periodicals and government publications. Added to these are thousands of unbound federal and state documents, agricultural and engineering experiment station and extension publications, and more than 12,000 pamphlets and clippings relating to Clemson College and South Carolina.

The Library is essentially a consolidation of special libraries: agriculture and the biological sciences, science and technology, and carefully selected smaller collections in the social sciences and humanities. The Library currently receives 1,938 periodical titles and more than 353 other continuations. Of these, about 314 are foreign publications. The Library receives forty newspapers.

### HOUSING FACILITIES

**Dormitories.** There are six dormitories for men. The room fees (\$86.00 per semester) are the same for all dormitories. Normally students are housed two per room, and room assignment is made insofar as possible in accordance with each student's preference.

All students living in the College dormitories must take their meals in the Dining Hall.



At the present time no dormitory facilities are available for women students, who must find housing facilities in the town of Clemson or surrounding areas.

**Family Housing.** Two housing projects are currently operated by the College for married students. The Veterans Village consists of 287 two-bedroom units. The monthly rental ranges from \$18.00 to \$27.00 and includes water and ground maintenance. Each unit is metered for electricity and bills are rendered monthly to tenants for electricity consumed.

The New Brick Apartments consist of fifty units with two bedrooms each. The monthly rental is \$31.00 to \$34.00 per month, which includes water, 300 kwh electricity per billing period, and ground maintenance.

A new housing project for married students consisting of 100 apartments, is under construction and should be completed by January 1959. The rental for these duplex apartments will be approximately \$35.00 per month.

Applications for married student housing should be made to the Director, College Housing Office.

### STUDENT HEALTH SERVICE

The Director of Student Health is in charge of the student health services at Clemson College. The medical fee paid by students is intended to cover all ordinary cases of sickness and their treatment. It is not intended to cover fees of doctors or specialists called into consultation, or the costs of operations, special nurses, ambulance service, and medical or surgical attentions performed away from the College. The right of the Director of Student Health Service, with the approval of the President of the College, to incur in behalf of any student under his care any of these extra services is hereby expressly reserved. Clemson College does not assume any responsibility for accidents that happen away from the College.

### STUDENT PLACEMENT

An office of student placement is maintained by the College in the Student Center. This office endeavors to assist all qualified students and former students in selecting suitable vocations, in arranging part-time work, and in obtaining career employment.



### COLLEGE REGULATIONS

The College and its various schools and departments reserve the right to change the rules regulating the admission to, instruction in and graduation from the College or its various schools, and any other regulations affecting the student body. Such regulations become effective whenever the proper authorities may determine and apply not only to prospective students but also to those who may at such time be matriculated in the College. The College also reserves the right to withdraw courses, to change instructors or to change fees at any time.

## GRADUATE SCHOOL INFORMATION

### REGULATIONS AND PROCEDURES

Every graduate student and every prospective graduate student is expected to make himself thoroughly familiar with the regulations of the Graduate School and the requirements for degrees. Failure to follow the regulations and requirements almost inevitably results in complications for which the Graduate School cannot assume responsibility.

In addition to the general regulations of the Graduate School, the candidate for an advanced degree will comply with the specific requirements of the department in which he is pursuing his advanced studies.

A student who wishes to deviate from the normal graduate school regulations and procedures may present his problem in a letter addressed to the Graduate Council signed by himself and his departmental adviser. The Graduate Council will consider the petition at the first meeting following its receipt in proper form. Action taken on a petition will not be considered a precedent for any future action.

### GRADUATE DEGREES AND CURRICULUMS

**Courses and Degrees.** Courses are offered leading to the degree of Master of Science in the following fields: Agricultural Economics, Agricultural Education, Agricultural Engineering, Agronomy, Animal Husbandry, Bacteriology, Ceramic Engineering,

Chemistry, Civil Engineering, Dairy, Education, Electrical Engineering, Entomology, Horticulture, Industrial Education, Mathematics, Mechanical Engineering, Nuclear Science, Physics, Plant Pathology, Textile Chemistry, and Zoology.

The degree of Master of Agricultural Education is offered by the Department of Agricultural Education. The degree of Master of Education is offered in the area of science teaching.

The degree of Doctor of Philosophy is offered in Agricultural Economics, Plant Pathology, and Entomology.

A list of courses which may be acceptable for graduate credit is found elsewhere in this Bulletin.

**Admission.** Before admission to the Graduate School a student must have the Bachelor's degree from an institution with a scholastic rating satisfactory to the College, must have made a satisfactory score on the Graduate Record Aptitude Tests or the South Carolina Entrance Examination, and must have the approval of the Head of the Department in which he plans to do his major work.

Admission is restricted to include only those students whose academic records clearly indicate that they are prepared to profit from graduate study. In general, an applicant should have an average undergraduate grade of B or better in his major field and C or better in his remaining course work. A satisfactory grade on an admissions test does not mean automatic admission. Graduate students are admitted as follows: (a) the Registrar recommends admission on the basis of test scores; (b) the department head recommends admission on the basis of a general review of the student's record; (c) the recommendations receive final action in the Graduate School Office.

Applicants accepted for graduate study may be admitted as graduate students in full standing or as provisional graduate students. Only graduate students in full standing may become candidates for advanced degrees.

Students classified as provisional are those

- (a) who do not plan to obtain a graduate degree from Clemson College; or



- (b) who have either general or specific deficiencies which require remedial work prior to admission to a degree program;  
or
- (c) whose undergraduate records are such as to make their status doubtful.

A provisionally admitted student may apply at any time to the Dean of the Graduate School for reclassification to full standing. An application for such reclassification should indicate that the student has successfully completed any required prerequisites, has maintained at least a "B" average for all courses taken as a graduate student, and desires a graduate degree from Clemson.

Appropriate graduate courses completed by a provisional student may be counted toward a degree program when the student has been reclassified.

Students desiring to enroll in the Graduate School must make application on Graduate School Form 1. This form may be obtained from the Director of Admissions. The application, accompanied by a transcript of previous college work and by such written recommendations as are necessary in support of the application, is returned to the Director of Admissions. The Registrar will not permit enrollment in courses of the 500 series until the student has been officially admitted to the Graduate School.\*

An applicant for admission to the Graduate School must register for courses within twelve months after his application has been accepted; otherwise the application will be considered invalid.

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\*Seniors who are within one semester of graduation and who have grade-point ratios of 3.0 or above may be permitted to register for courses of the 500 series provided their total load is not more than 15 hours, and provided such 500 courses are in addition to the requirements for the undergraduate degree. These courses will not be recorded as graduate credit, but if these students are subsequently admitted to the Graduate School at this institution they may request that these courses be included as a part of their graduate program.



**Academic Standards.** Graduate students are graded on the same A-B-C-D-F scale as undergraduates. Nonetheless a graduate student is expected to do superior work.

Courses primarily for graduate credit are those of the 500 series. Graduate credit may be received for a grade of C on 500 series courses; however the grade on a credit hour basis for all 500 series courses must average B or better before the student can become eligible for an advanced degree. To receive graduate credit for a course in the 300 or 400 series a student must attain a grade of B or better. No student shall receive both graduate and undergraduate credit for the same course.

A grade lower than the specified minimum can be raised to count toward an advanced degree only by repetition of the course.

A graduate student must understand that he can be dropped from the Graduate School roll at any time for failure to maintain an adequate academic status.

**Eligibility of College Employees to Pursue Graduate Study.** With the approval of his Dean or Director, a qualified employee of Clemson College may pursue graduate work for credit. However, no member of the faculty or staff who has a rank higher than Instructor or its equivalent may be considered as a candidate for an advanced degree at this institution.

**Maximum Credit Load.** The maximum load for students who are devoting all of their time to graduate work is fifteen credit hours per semester, or one credit hour per week during the Summer School. Persons who are employed by the College on a full-time basis may not carry more than six semester credits per semester. The maximum graduate load for students devoting part-time to staff duties or research work will be determined by their total work load. The work load is the number of credit hours taken or taught multiplied by three plus the actual number of hours per week spent in performing other staff duties or research work. For students devoting part-time to graduate study, the total work load per week for the first semester of graduate enrollment must not exceed 48 hours. After the first semester, a part-time student whose work is superior may, with the approval of the head of his

major department and the Dean of the Graduate School, schedule a work load in excess of 48 hours but not in excess of 60 hours.

In the event of scheduling difficulties, a part-time student may, with the approval of the persons named above, exceed the limits specified by not more than three work load hours for any one semester, provided the average work load for the academic year does not exceed these limits.

**Auditing by Graduate Students.** A graduate student regularly enrolled for a minimum of six semester hours may audit without charge (special course fees excepted) one additional course, provided approval is obtained from the professor offering the course and the head of the department and dean of the school in which the course is offered. Forms for requesting such approval are available at the Registrar's Office.

Audited courses do not carry credit and the fact that a course has been audited is not noted on the graduate student's official record. Audited courses do not count against allowable credit-hour loads.

Graduate auditors are not required to stand tests or examinations. However the professor, at his own discretion, may demand or deny the auditor's participation in class to whatever extent he deems desirable.

A graduate student may not by audit satisfy a stated prerequisite for a graduate course unless such is agreed to by the head of the department requiring the prerequisite. Additionally, a graduate student may not establish credit through examination in any course for which he was previously registered as an auditor.

**Filing of Preliminary Study Plan.** Graduate students, within one month after registering for graduate credit, should file with the Dean of the Graduate School a preliminary study plan. The form for this plan (G. S. Form 2) may be obtained from the student's department head or from the Graduate School Office. Changes in the student's preliminary plan of study may be requested at any time. Proposals for change should originate in consultation between the student and his major adviser, be approved in writing by the heads of the student's major and minor departments, and forwarded in quadruplicate to the Dean of the Graduate School.



**The Student's Advisory Committee.** At the time of or before his admission to candidacy for an advanced degree, each graduate student will be assigned to a major adviser and an advisory committee. The procedure for selecting these advisers is:

**For the Master's Students.** As soon as the student's preliminary plan of study is filed and his objectives crystallized he will, with the approval of the head of his major department, select a major adviser. The major adviser in consultation with the student will recommend to the Dean of the Graduate School for approval and formal appointment at least two associate advisers, one of whom shall represent the student's minor field of study. These associate advisers, with the major adviser as chairman, will constitute the student's advisory committee which will supervise his graduate program, administer his final comprehensive examination, and initiate the recommendation for the awarding of his degree.

**For the Doctoral Student.** Not later than the time of his initial registration in a doctoral program the student shall designate in writing to the Dean of the Graduate School his selection of a major field and two minor fields of study. The student and the heads of these departments in consultation will recommend to the Graduate Dean for approval and formal appointment an advisory committee composed of at least five professors. One member of the committee will be designated as chairman and will direct the student's dissertation. The advisory committee will aid the student in planning his course work; arrange for his preliminary and final comprehensive examinations; and initiate the recommendation for the awarding of his degree.

**Admission to Candidacy for a Graduate Degree.** Admission to the Graduate School does not qualify a student as a candidate for an advanced degree. Such candidacy depends on the acceptance by the Dean of the Graduate School of a written request for admission to candidacy. This request (G.S. Form 4) should be filed by the student once he has completed at least one-half his prescribed graduate residence and course work, (research courses excepted), and has successfully undertaken whatever preliminary or qualifying examinations are required. This request for admission to candidacy must list each of the major and minor subjects to be offered for the



degree and must contain the title of the proposed thesis or research report. The request should bear the signed approval of the heads of the major and minor departments concerned. A student must be admitted to candidacy for a Master's degree at least one semester, and for a Doctor of Philosophy degree at least two semesters, before the date on which the degree is expected.

**The Thesis and Thesis Abstract.** Each candidate for an advanced degree (except those of Master of Agricultural Education and Master of Education) is required to prepare a thesis under the direction of a major adviser. Six hours of credit are allowed for the research leading to the required Master's thesis.

Three typewritten copies of the thesis (the original copy and the first and second carbons) must be presented to the chairman of the student's advisory committee in sufficient time for the chairman to arrange for a final examination to be held at least two weeks prior to the date on which the degree is expected. A doctoral thesis must be completed and accepted by the student's advisory committee at least two weeks prior to the final examination. The three copies of the thesis must be submitted to the Dean of the Graduate School at least one week prior to the date on which the degree is conferred. A binding fee of \$9.00 must be paid to the Bursar and the Bursar's receipt submitted to the Graduate School Office at the time the thesis is submitted. If the student desires, he may have an additional copy of his thesis bound for himself at a cost of \$3.00. The responsibility for placing the thesis in proper final form rests with the student and the chairman of his advisory committee. A statement of special procedures for writing a thesis at Clemson College may be obtained from the Graduate School Office.

The student will prepare an abstract of his thesis which must be submitted in triplicate with the thesis to the Dean of the Graduate School. Ordinarily this abstract should not exceed five hundred words in length. It should be written and edited in such a way that it will be suitable for publication. Each copy of the abstract should carry the signed approval of the chairman of the student's advisory committee.

**Language Examinations.** Certain advanced degrees require that the student demonstrate a reading knowledge of one or more for-

eign languages. Language examinations are given by the Language Department each semester at a stated time as announced by the Dean of the Graduate School.

The language examinations are taken from sources supplied to the Language Department by the student's major department. The major department supplies at least one book in the student's field, from which the Language Department chooses the section to be translated. Examinations are confined to reading knowledge with dictionary and normally are "time limit" in character.

**Application for a Diploma.** A formal application for a diploma must be placed by the student with the Registrar at least two months prior to the date on which the degree is to be conferred. At this time the diploma fee of \$3.00 (or \$6.50 if a diploma case is desired) must be paid. Arrangements should be made at this time for cap and gown rental. The student, unless specifically excused by the College President, must attend commencement exercises in order to obtain his degree.

### **ADDITIONAL REQUIREMENTS FOR MASTER OF SCIENCE DEGREE**

To receive the Master of Science degree a student must spend the equivalent of at least one academic year in graduate residence at the College.\* No graduate credit will be allowed for any course completed in less than six weeks. Normally no credit toward a graduate degree may be obtained by correspondence or extension study. All course work which is to be credited toward a Master of Science degree must have been completed not more than six calendar years prior to the date on which the degree is to be awarded; except that when approved by the student's department head and the Dean of the Graduate School, as many as six semester hours of course work completed outside the six-year limit of time may be validated by written re-examination. Such examination will be

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\*An academic year in graduate residence is defined as a minimum of two regular semesters (or summer equivalent) of enrollment, and the successful completion of a minimum of eighteen hours of course work, exclusive of research.



under the direction of the department regularly offering the course or courses for which the student seeks validation. Course work completed outside the six-year limit of time at an institution other than Clemson College may not be transferred to Clemson for graduate credit.

**Course Work Required.** In addition to such supplementary or supporting courses as may be required, the work will consist of a minimum of thirty semester hours, including six semester hours of research which will provide the basis for the required thesis. Of the remaining twenty-four semester hours, at least twelve hours must come from courses numbered 500 or above. A minimum of twelve hours must be in the student's major field and a minimum of six hours in one minor.

**Transferred Credits.** As many as six semester hours of credit obtained in a different but recognized institution may be transferred and credited to the Master's degree, provided the work was of graduate character.

**Final Examination.** Each candidate for a Master's degree, after the completion of the required thesis and at least two weeks before the degree is to be awarded must pass such examination as may be required by the student's advisory committee. The examination, which may be oral or written, will ascertain the general knowledge of the candidate with particular reference to the major and minor subjects and the thesis or research report. Included with those members of the faculty and staff invited to attend the examination will be the Dean of the Graduate School and members of the Graduate Council. Immediately after the examination the examining committee will notify the Dean of the Graduate School of its findings. This notification will be made on Graduate School Form 7.

#### **ADDITIONAL REQUIREMENTS FOR MASTER OF SCIENCE DEGREE IN NUCLEAR SCIENCE**

To receive the Master of Science degree in Nuclear Science the student must complete on campus at least twenty-four semester hours of acceptable course work (exclusive of thesis courses) in



Chemistry, Mathematics, and Physics. At least twelve of the twenty-four hours shall be in courses of the 500 series. Eighteen of the required hours will be the following:

|                            |                                |       |
|----------------------------|--------------------------------|-------|
| Chemistry 491              | Introduction to Radiochemistry | 3 cr. |
| Chemistry 542              | Radiochemistry                 | 3 cr. |
| Mathematics 453<br>and 454 | Advanced Calculus              | 6 cr. |
| Physics 452                | Atomic and Nuclear Physics     | 3 cr. |
| Physics 543                | Reactor Theory I               | 3 cr. |

If any of the above courses have already been satisfactorily completed by the student as an undergraduate, other courses in the same field of study shall be substituted as approved by the student's advisory committee.

Thesis research for the degree will be carried out under the supervision of college and du Pont scientists at the Savannah River Atomic Energy Commission Operations Plant near Aiken, South Carolina. A student entering this phase of work must receive security clearance by the United States Government.

Prior to admission to candidacy for the degree, the student must pass a reading knowledge test in the German language.

### ADDITIONAL REQUIREMENTS FOR THE MASTER OF AGRICULTURAL EDUCATION DEGREE

**Course Work Required.** In addition to such supplementary or supporting courses as may be required, the work for the Master of Agricultural Education degree shall consist of a minimum of thirty-three semester hours, at least eighteen of which shall be earned in courses numbered above 500. The course requirements will be distributed as follows:

1. Twelve hours shall be in Education, as a major.
2. Twelve hours shall be in technical agriculture. Six of these hours must be in the same field and will be considered as a minor.
3. Three hours shall be in a discipline outside the field of the major.
4. Three hours shall be in agricultural research techniques and three in experimental statistics.

With the exception of the thesis and foreign language proficiency, all other regular requirements of the Graduate School for the Master of Science degree will be met.

### **ADDITIONAL REQUIREMENTS FOR MASTER OF EDUCATION DEGREE**

The Master of Education degree is offered only in the area of high school science teaching. The degree is considered merely as a stopgap in the development of teacher education programs. In the final analysis, a high school teacher should have the Bachelor's degree in the field in which he wishes to teach and the Master's degree should be taken in the same or a related field.

The following special requirements apply to the Master of Education degree:

1. The candidate shall take a major in the natural sciences and/or mathematics and a minor in education.
2. At least thirty semester hours must be satisfactorily completed (at least fifteen in the 500 series), of which at least eighteen must be in the field of the major and not more than twelve in the field of the minor.
3. The special "T" series subject matter courses in the sciences and mathematics particularly developed for training science teachers will provide the basic subject matter courses, but regular graduate courses in the sciences or mathematics may be included in the degree program subject to the approval of the student's adviser.

With the exception of the thesis and foreign language proficiency, all other regular requirements of the Graduate School for the Master of Science will be met.

### **ADDITIONAL REQUIREMENTS FOR DOCTOR OF PHILOSOPHY DEGREE**

Work leading to the Doctor of Philosophy degree is planned in such a way as to give the student a comprehensive knowledge of his fields of specialization and a mastery of the methods of research. The degree is not awarded solely on the basis of course work completed, residence or other routine requirements. The



final basis for granting the degree will be the student's grasp of the subject matter of a broad field of study, his competency to plan and conduct research, and his ability to express himself adequately and professionally in oral and written language.

**Residence Requirements.** To receive the Doctor of Philosophy degree the student must spend the equivalent of at least three academic years in full residence as a graduate student. At least one academic year (ordinarily the second) must be in continuous resident study at this institution. The definition of an academic year in residence is found elsewhere in this Bulletin.

**Time Limit.** All work for a Doctor of Philosophy degree must be completed within a period of seven years. If the student begins his doctoral program after receiving the Master's degree, all work above the Master's level must be completed within a six-year period.

**Language Requirement.** A reading knowledge of both French and German is required of all candidates for the doctorate; except that other languages may be substituted in cases where it is demonstrated that they will be of more value in the particular specialty of the student. Such substitutions must be approved by the student's department head and by the Dean of the Graduate School. All language requirements must have been satisfied prior to the student's preliminary or qualifying examination and prior to his admission to candidacy for the degree.

**Qualifying Examinations Before Admission to Candidacy.** The student must undertake such preliminary or qualifying examinations as may be prescribed before he applies for admission to candidacy for his degree. These examinations may be written, oral, or a combination of both. The function of the examinations is to obtain objective evidence of an adequate intellectual mastery of the student's areas of major and minor specialization.

The student's performance on these examinations will determine whether the heads of his major and minor departments shall recommend acceptance of his application for admission to candidacy. Immediately after the examination the examining committee will notify the Dean of the Graduate School of its findings.



Should the student fail to pass his preliminary examinations he may be given the opportunity to undergo the examinations a second time. A second failure shall result in the student's being declared ineligible for the Doctor of Philosophy degree at Clemson College.

**Final Doctoral Oral Examination.** The candidate for the Doctor of Philosophy degree must pass a final oral examination at least two weeks prior to the time of the convocation at which he plans to obtain the degree. The examination will be conducted by the student's advisory committee, and all faculty members will be invited to participate. The Graduate School Office will be notified of the time and place of the examination at least ten days prior to the time scheduled.

This final examination demands a broad and penetrating interpretation by the student of his research project and conclusions. It may include examination of the student in his major and minor fields of specialization.

### COURSES OF STUDY

The courses listed below will carry graduate credit when properly approved by graduate advisers. Courses of the 500 series are specially designed for graduate student enrollment. Courses of the 300 and 400 series will enroll undergraduate and graduate students; however, the graduate students will normally be expected to complete such additional assignments as instructors may require.

Complete descriptions of the 300 and 400 series courses listed in this **Bulletin** may be found in the general College Catalog, obtainable from the Registrar.

### AGRICULTURAL ECONOMICS

**G. H. Aull, Chairman**

Courses are offered leading to the degrees of Master of Science and Doctor of Philosophy.

Ag Ec 352—PUBLIC FINANCE—3 cr. (3 and 0)

Ag Ec 357—CONSERVATION OF NATURAL RESOURCES—3 cr. (3 and 0)

Ag Ec 401—STATISTICS—3 cr. (2 and 3)

Ag Ec 451—AGRICULTURAL COOPERATION—2 cr. (2 and 0)

Ag Ec 452—AGRICULTURAL POLICY—3 cr. (3 and 0)

Ag Ec 456—PRICES—3 cr. (3 and 0)

Ag Ec 460—AGRICULTURAL FINANCE—2 cr. (2 and 0)

Ag Ec 462—APPLIED STATISTICS—3 cr. (2 and 3)

Ag Ec 501—ADVANCED FARM MANAGEMENT—3 cr. (2 and 3)

Study and appraisal of methods of assembling and analyzing information concerning the business of farming. **Prerequisites:** Ag Ec 302 and Ag Ec 401.

Ag Ec 503—LAND ECONOMICS—3 cr. (3 and 0)

A study of the characteristics of land and its utilization in relation to population and public policies.

Ag Ec 505—ECONOMIC THEORY—3 cr. (3 and 0)

A study of the use of theory in the analysis of economic problems and an appraisal of recent developments in capitalistic economic theory.

Ag Ec 507—AGRICULTURAL MARKETING PROBLEMS—3 cr. (3 and 0)

A study of special problems involved in research and marketing southern fruits, vegetables, livestock and livestock products. Students will undertake individual assignments in the field of their interest. **Prerequisite:** Ag Ec 309 or permission of instructor.

Ag Ec 512—EXPERIMENTAL DESIGNS—3 cr. (3 and 0)

An examination of the ways to plan and conduct comparative experiments so they will provide, efficiently, specific answers to scientific questions under investigation. **Prerequisite:** Ag Ec 401 or permission of instructor.

Ag Ec 514—CONTEMPORARY ECONOMIC PROBLEMS—3 cr. (3 and 0)

A critical review of the nature of contemporary economic problems, the background out of which they developed, the remedies which have been applied, and possible alternatives. (Special emphasis will be given to problems relating to agriculture and rural life.)

Ag Ec 591—THESIS RESEARCH—3 cr.

Ag Ec 592—THESIS RESEARCH—3 cr.

## AGRICULTURAL EDUCATION

J. B. Monroe, Chairman

Courses are offered leading to the degrees of Master of Science and Master of Agricultural Education.



Students desiring to pursue graduate work with a major in the field of Agricultural Education are expected to have as prerequisite enough work in this field to qualify them for a Class III teacher's certificate under the rules of the State Board of Education.

Ag Ed 401—METHODS IN AGRICULTURAL EDUCATION—3 cr. (2 and 3)

Ag Ed 463—ADVANCED CONSERVATION EDUCATION—3 cr. (3 and 0)

Ag Ed 501—RECENT DEVELOPMENTS IN THE TECHNOLOGY OF AGRICULTURE—3 cr. (2 and 3)

Includes a thorough analysis and appraisal of the experimental findings and successful farming practices developed during World War II and in the post war period in the various fields of agriculture. Emphasis in this course will be on crops and mechanization.

Ag Ed 502—RECENT DEVELOPMENTS IN THE TECHNOLOGY OF AGRICULTURE—3 cr. (2 and 3)

A continuation of Ag Ed 501 with emphasis in developments in animal sciences and agricultural economics.

Ag Ed 504—SPECIAL PROBLEMS IN TEACHING VOCATIONAL AGRICULTURE—3 cr. (2 and 3)

This course will be devoted to the analysis, exploration and development of plans for the solution of some of the current problems being encountered by teachers of Vocational Agriculture.

Ag Ed 515—ADVANCED METHODS OF TEACHING FARM MECHANICS—3 cr. (2 and 3)

Organization of teaching units, methods of determining the content of the course, securing and equipping the shop, teaching farm mechanics and other shop problems which are involved in teaching farm people are considered in this course.

Ag Ed 520—TEACHING YOUNG FARMERS—3 cr. (3 and 0)

The purpose of this course is to provide training for young farmers establishing themselves in the business of farming. Emphasis will be placed upon organization, cooperation and private enterprise. Buying and selling of various types of markets will be covered. The uses of governmental facilities for handling goods, credit, communications, and power will be studied. Conservation as a community and individual enterprise will be discussed.

Ag Ed 525—SUPERVISION OF STUDENT TEACHING—3 cr. (3 and 0)

In this course major emphasis is placed upon the following; (1) developing a point of view or philosophy of teacher education; (2) analyzing the present teacher training program in South Carolina, to discover problem situations that may be used as a basis for teacher education programs; (3) determining the relative emphasis for each teacher to place upon the solution of the problems in the teacher-education program; (4) projecting



plans for an apprentice training program; and (5) supervising apprentice training in the state.

Ag Ed 591—INTRODUCTION TO RESEARCH IN EDUCATION—3 cr.

Ag Ed 592—RESEARCH IN AGRICULTURAL EDUCATION—3 cr.

## AGRICULTURAL ENGINEERING

A. W. Snell, Chairman

Courses are offered leading to the Master of Science degree with majors in general Agricultural Engineering and in Ginning Engineering.

Ag En 352—FARM POWER—3 cr. (2 and 3)

Ag En 360—FARM AND HOME UTILITIES—3 cr. (2 and 3)

Ag En 401—SOIL AND WATER CONSERVATION ENGINEERING—3 cr.  
(2 and 3)

Ag En 402—DRAINAGE AND IRRIGATION—3 cr. (2 and 3)

Ag En 451—FARM STRUCTURES—3 cr. (2 and 3)

Ag En 452—ADVANCED FARM STRUCTURES—3 cr. (2 and 3)

Ag En 481—FUNDAMENTALS OF GIN ENGINEERING—3 cr. (2 and 3)

Ag En 501—SPECIAL PROBLEMS IN AGRICULTURAL ENGINEERING  
—3 cr. (3 and 0)

Each student will select a subject pertaining to his particular interest or major field of study in Agricultural Engineering. Library and/or laboratory research will be conducted and a technical report will be written. The subject may be selected from one of the following: (a) Power and Machinery, (b) Soil and Water, (c) Farm Structures, or (d) Rural Electrification.

Ag En 504—ENGINEERING APPLICATIONS TO AGRICULTURE PROCESSING—3 cr. (2 and 3)

A course dealing with the unit operation involved in the processing of agricultural products. The application of engineering principles and instrumentation to size reduction, cleaning and grading, mixing, materials handling, work simplifications, dehydrating and drying, refrigeration, storage, and related subjects.

Ag En 511—DESIGN OF FARM MACHINERY—3 cr. (3 and 0)

A study of the design and selection of the mechanical units of machines will be made with emphasis on their application to the agricultural implement field. **Prerequisite:** Mech 304 and Ag En 406.

Ag En 512—DESIGN OF FARM MACHINERY—3 cr. (2 and 3)

Problems in agricultural implement design will be chosen to coordinate the design of functional units of farm machines with the selection of machine members. **Prerequisite:** Ag En 511.

**Ag En 522—ADVANCED DRAINAGE & IRRIGATION ENGINEERING—  
3 cr. (3 and 0)**

A study of theory and principles of drainage, irrigation and water storage. Principal topics include theory and application of flow of water through soil in unsaturated and saturated states, flow nets and seepage forces, and the fundamentals of engineering design with respect to ground water problems and soil moisture relationships. **Prerequisite:** Ag En 401, 402 or by special permission.

**Ag En 582—ADVANCED GIN ENGINEERING—3 cr. (3 and 0)**

Design, development, analysis and synthesis of gin machinery to meet the functional requirements necessary for processing and handling cotton in modern gin establishments. Special emphasis is placed on the problems created by the introduction of mechanical harvesters. Special problems are assigned to give the student an opportunity for independent thinking. **Prerequisites:** Mech 304 and Ag En 406 or equivalent.

**Ag En 591—RESEARCH—3 cr.**

**Ag En 592—RESEARCH—3 cr.**

### **AGRONOMY AND SOILS**

**G. H. Collings, Chairman**

**Courses are offered leading to the Master of Science degree.**

**Agron 301—FERTILIZERS AND MANURES—3 cr. (3 and 0)**

**Agron 302—GENETICS—3 cr. (2 and 3)**

**Agron 306—FORAGE AND PASTURE CROPS—3 cr. (3 and 0)**

**Agron 403—SOIL CLASSIFICATION—2 cr. (1 and 3)**

**Agron 405—PLANT BREEDING—3 cr. (2 and 3)**

**Agron 409—COTTON AND TOBACCO—3 cr. (3 and 0)**

**Agron 452—SOIL FERTILITY AND MANAGEMENT—2 cr. (2 and 0)**

**Agron 455—SEMINAR—1 cr. (1 and 0)**

**Agron 456—SEMINAR—1 cr. (1 and 0)**

**Agron 501—ADVANCED NUTRITION OF CROPS—3 cr. (3 and 0)**

A course dealing with the relationship existing between the physical and chemical properties of the various nutrient elements and their absorption and utilization by plants.

**Agron 502—ADVANCED PEDOLOGY AND SOIL CLASSIFICATION—  
3 cr. (3 and 0)**

A course dealing largely with the factors of soil formation and soil classification. A study is made of such factors of soil formation as parent material, topography, climate, and organisms. Particular attention is given to the classification of Southeastern soils.



**Agron 503—ADVANCED CROP PRODUCTION—3 cr. (3 and 0)**

A course dealing with specific problems commonly encountered in the production of crops in the Southeast. Major attention is given to the production of cotton, bright tobacco, corn and oats.

**Agron 504—ADVANCED PLANT BREEDING AND GENETICS—3 cr. (3 and 0)**

A course designed to acquaint the student with the best methods now employed in the production and development of superior strains of plants. Visits will be made to neighboring plant breeding establishments and their methods will be observed.

**Agron 505—ADVANCED SOIL FERTILITY—3 cr. (3 and 0)**

A course dealing with soil conditions affecting plant growth, soil and plant relationships from the standpoint of normal growth under field conditions, and the essential principles in improving and maintaining soil fertility.

**Agron 506—SPECIAL PROBLEMS—2 to 4 cr.**

Original investigation of special problems in Agronomy which are not related to a thesis but designed to provide experience and training in research.

**Agron 507—SOIL PHYSICS—3 cr. (2 and 3)**

A study of fundamental principles of soil physics, methods of physical analysis of soils, and applications of soil physics in Agriculture.

**Agron 591—RESEARCH—3 cr.****Agron 592—RESEARCH—3 cr.****ANIMAL HUSBANDRY**

**R. F. Wheeler, Chairman**

**Courses are offered leading to the Master of Science degree.**

**AH 310—PORK PRODUCTION—3 cr. (3 and 0)****AH 314—PORK PRODUCTION LABORATORY—1 cr. (0 and 3)****AH 401—BEEF PRODUCTION—3 cr. (3 and 0)****AH 403—BEEF PRODUCTION LABORATORY—1 cr. (0 and 3)****AH 452—ANIMAL BREEDING—3 cr. (2 and 3)****AH 453—MEATS—1 cr. (1 and 0)****AH 455—MEATS LABORATORY—2 cr. (0 and 6)****AH 502—TOPICAL PROBLEMS—1-3 cr. (1-3 and 0)**

A critical study of Animal Husbandry experiments and the interpretation of their results.



**AH 504—METHODS IN ANIMAL BREEDING—3 cr. (3 and 0)**

A study of factors governing gene and zygotic frequency; systems of mating; heritabilities; genetic consequences of selection; and criteria for evaluating improvement in beef cattle, swine, and sheep.

**AH 505—NUTRITION OF MEAT ANIMALS—3 cr. (3 and 0)**

A course dealing with the metabolism of carbohydrates, lipids, proteins, inorganic elements, and vitamins in the nutrition of beef cattle, swine, and sheep; the nutrient requirements of meat animals with special emphasis on the properties and functions of nutrients.

**AH 591—RESEARCH—3 cr.****AH 592—RESEARCH—3 cr.****BACTERIOLOGY**

**W. M. Epps, Chairman**

**Courses are offered leading to the Master of Science degree.**

**Bact 301—GENERAL BACTERIOLOGY—4 cr. (3 and 3)****Bact 310—ADVANCED BACTERIOLOGY—4 cr. (2 and 6)****Bact 402—DAIRY BACTERIOLOGY—3 cr. (2 and 3)****Bact 406—SANITARY BACTERIOLOGY—4 cr. (3 and 3)****Bact 410—SOIL MICROBIOLOGY—3 cr. (2 and 3)****Bact 501—BACTERIAL TAXONOMY—3 cr. (2 and 3)**

This course covers the history of determinative bacteriology, and the basic morphological, cultural, and physiological differences used in distinguishing between the various taxonomic groups of bacteria. Opportunity will be given in the laboratory to isolate and identify bacteria from natural sources. **Prerequisites:** Bact 301, 310, and organic chemistry.

**Bact 502—ADVANCED BACTERIOLOGICAL TECHNIC—4 cr. (2 and 6)**

A course including methods of preparing special equipment for use in the bacteriological laboratory, sterilization by filtration, isolation of viruses, immunological procedures, and the experimental infection of animals. This course is designed to give students interested in research in the field of bacteriological experience in more advanced methods of investigation. **Prerequisites:** Bact 301, 310, and organic chemistry.

**Bact 505—PHYSIOLOGY OF BACTERIA—3 cr. (2 and 3)**

A study of bacterial cytology, enzymes, growth curves, respiration, aerobiosis, anaerobiosis, nutrition of bacteria and degradation of proteins, carbohydrates, and fats. **Prerequisites:** Bact 301, 310, and organic chemistry.

**Bact 591—RESEARCH—3 cr.****Bact 592—RESEARCH—3 cr.**

## BOTANY

W. M. Epps, Chairman

The Master of Science degree is offered in Botany and Plant Pathology.  
The Doctor of Philosophy degree is offered in Plant Pathology.

Bot 351—PLANT MORPHOLOGY—4 cr. (2 and 6)

Bot 352—PLANT PHYSIOLOGY—4 cr. (3 and 3)

Bot 355—HISTOLOGY—2 cr. (0 and 6)

Bot 356—TAXONOMY—3 cr. (1 and 6)

Bot 401, 403—PLANT PATHOLOGY—3 cr. (2 and 3)

Bot 451—MORPHOLOGY OF THE FUNGI—3 cr. (2 and 3)

Bot 501—ADVANCED PHYSIOLOGY—4 cr. (2 and 6)

A theoretical and practical study of methods used in investigation of physiological processes and the factors influencing those processes. Topics include sand and solution culture methods, measurement and control of soil water content, atmospheric humidity and radiant energy, and determinations of osmotic quantities, hydrogen ion concentration, and metabolic processes. **Prerequisites:** Bot 352; Chem 101, 102; Phys 201, 202, 203, 204.

Bot 502—ADVANCED MYCOLOGY—3 cr. (2 and 3)

A course designed chiefly for students majoring in plant pathology and closely allied fields. A detailed study is made of specific groups of fungi, especially those of economic importance of this region. Emphasis is placed on field collection identification, morphology, and cytology through lectures and student reports and laboratory work. **Prerequisites:** Bot 356, 451.

Bot 503—ADVANCED PLANT PATHOLOGY—4 cr. (3 and 3)

Essentially an introduction to research on plant diseases with review and recording of literature; preparation of media; isolation of single-cells of organisms in pure culture; a class study of infection and epidemiology of one fungus, one bacterial, and one virus disease; and an individual "problem" with preparation of a manuscript according to standards of a scientific journal. **Prerequisites:** Bot 401, 403.

Bot 504—PHYSIOLOGY OF PARASITISM IN PLANTS—3 cr. (3 and 0)

This course is designed to acquaint the student with the interaction of host and parasite as affected by environmental conditions and nutrition of the host. Emphasis will be given to the factors that influence infection and the development of the parasite within the host. **Prerequisites:** Bot 351, 352, 401, and 403.

Bot 505—SPECIAL PROBLEM IN PLANT PATHOLOGY—\*

Original investigation of special problems in plant pathology which are not related to a thesis but designed to provide experience and training in research. **Prerequisite:** Graduate standing and permission of instructor.



Bot 506—CHEMICAL CONTROL OF PLANT DISEASES—2 or 4 cr. (2 and 0 or 2 and 6)

An introduction to the chemicals used in the control of plant diseases, the nature of their action on fungi, their application and methods of evaluation. Laboratory facilities are available for qualified students who may wish to evaluate chemicals in respect to their effectiveness in the control of specific plant diseases. **Prerequisites:** Bot 401, 403, and organic chemistry.

Bot 591—RESEARCH—3 cr.

Bot 592—RESEARCH—3 cr.

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\*Hours of credit to be arranged with instructor. Credit will be given under Bot 505 for special problems performed in connection with other graduate courses.

## CERAMIC ENGINEERING

G. C. Robinson, Chairman

Courses are offered leading to the degree of Master of Science.

Cr Ar 301—POTTERY GLAZES—3 cr. (3 and 0)

Cr Ar 401—ADVANCED POTTERY—3 cr. (2 and 3)

Cr En 301—THE DRYING AND FIRING OF CERAMIC PRODUCTS—4 cr. (3 and 3)

Cr En 305—THERMO-CHEMICAL CER.—5 cr. (3 and 6)

Cr En 402—CERAMIC BODIES—3 cr. (3 and 0)

Cr En 403—GLASSES—3 cr. (3 and 0)

Cr En 404—ENAMELS—3 cr. (3 and 0)

Cr En 410—GLASS MANUFACTURE—3 cr. (3 and 0)

Cr En 412—RAW MATERIAL PREPARATION—3 cr. (3 and 0)

Cr En 416—CEMENT, LIME AND PLASTER—3 cr. (3 and 0)

Cr En 418—PROCESS CONTROL—3 cr. (3 and 0)

Cr En 419—PHYSICAL CERAMICS—3 cr. (3 and 0)

Cr En 420—PHYSICAL CERAMICS—3 cr. (3 and 0)

Cr En 501—ADVANCED ANALYTICAL PROCEDURES AND EQUIPMENT—3 cr. (2 and 3)

The use and application of the X-ray, spectograph, and electron microscope in ceramics.

**Cr En 502—SILICATE CRYSTALLOGRAPHY—3 cr. (3 and 0)**

The basic laws of chemical crystallography and their application to the structure of silicate minerals.

**Cr En 503—CERAMIC PRODUCTION CONTROL—3 cr. (3 and 0)**

The techniques and procedures for providing the required quantity and quality of materials at the required time and place in ceramic industries. Motion study, job analysis, job and wage evaluation in these industries.

**Cr En 504—CERAMIC QUALITY CONTROL—3 cr. (3 and 0)**

Organization and procedure for quality control in ceramic industries. Practices and techniques used for systematic control of ceramic products and materials.

**Cr En 505—ADVANCED DRYING—3 cr. (2 and 3)**

Drying fundamentals, drying problems, and dryer design.

**Cr En 506—ADVANCED FIRING—3 cr. (2 and 3)**

Fuels, combustion, heat transfer, firing problems, and firing equipment.

**Cr En 507—SPECIALIZED CERAMICS—3 cr. (3 and 0)**

An advanced study of one of the divisions of ceramics. The student may select either structural products, refractories, whitewares, abrasives, enamels, glass, elements, or raw materials processing.

**Cr En 591—RESEARCH—3 cr.****Cr En 592—RESEARCH—3 cr.****CHEMICAL ENGINEERING**

**C. E. Littlejohn, Chairman**

**The department does not award advanced degrees. Courses are offered to provide minor field specification.**

**ChE 301—PRINCIPLES OF CHEMICAL ENGINEERING—3 cr. (3 and 0)****ChE 302—PRINCIPLES OF CHEMICAL ENGINEERING—3 cr. (3 and 0)****ChE 306—UNIT OPERATIONS—1 cr. (0 and 3)****ChE 330—CHEMICAL ENGINEERING THERMODYNAMICS—2 cr.  
(2 and 0)****ChE 401—PRINCIPLES OF CHEMICAL ENGINEERING—3 cr. (3 and 0)****ChE 406—INDUSTRIAL CHEMICAL CALCULATIONS—2 cr. (2 and 0)****ChE 407—UNIT OPERATIONS—2 cr. (0 and 6)****ChE 409—PLANT DESIGN—2 cr. (0 and 6)****ChE 415—INTRODUCTION TO NUCLEAR ENGINEERING—3 cr. (3 and 0)**



ChE 416—INTRODUCTION TO NUCLEAR ENGINEERING—3 cr. (3 and 0)

ChE 420—CORROSION—3 cr. (3 and 0)

ChE 421—DIMENSIONAL ANALYSIS AND THE THEORY OF MODELS—  
2 cr. (2 and 0)

ChE 422—INDUSTRIAL WASTE TREATMENT—2 cr. (2 and 0)

ChE 430—CHEMICAL ENGINEERING THERMODYNAMICS—3 cr.  
(3 and 0)

### CHEMISTRY

F. I. Brownley, Chairman

**Courses are offered leading to the Master of Science degree.**

A graduate student who registers for graduate work in Chemistry must have satisfactorily completed as a minimum the following undergraduate courses before he formally becomes a candidate for the degree. Anyone who has not satisfied these requirements before entering the graduate school will be required to add such courses to his graduate program.

|                               |  |
|-------------------------------|--|
| One year of General Chemistry | One course in Qualitative Analysis<br>(if not included in General Chemistry) |
|-------------------------------|--|

|                               |  |
|-------------------------------|--|
| One year of Organic Chemistry | One course in Elementary Quantitative Analysis |
|-------------------------------|--|

A placement examination is required of each student at the time he begins his graduate program. A satisfactory performance is required on a comprehensive written examination at least two months prior to the final oral examination.

Before receiving his degree a student must demonstrate a satisfactory reading knowledge of a modern foreign language. This language will ordinarily be German unless some other language is recommended by the student's committee.

Either a major or minor may be taken in one or more of the following fields of Chemistry: Inorganic, Analytical, Organic or Physical. A minor may also be taken in some field other than Chemistry.

\*Chem 310—AGRICULTURAL BIOCHEMISTRY—4 cr. (3 and 3)

\*Chem 323—ELEMENTARY ORGANIC CHEMISTRY—4 cr. (3 and 3)

\*Chem 324—ELEMENTARY ORGANIC CHEMISTRY—4 cr. (3 and 3)

\*Chem 331—PHYSICAL CHEMISTRY—5 cr. (3 and 6)

\*Chem 332—PHYSICAL CHEMISTRY—5 cr. (3 and 6)

\*Chem 335—PHYSICAL CHEMISTRY—3 cr. (3 and 0)

\*Chem 336—PHYSICAL CHEMISTRY—2 cr. (2 and 0)

\*Chem 337—PHYSICAL CHEMISTRY—4 cr. (3 and 3)

\*Chem 338—PHYSICAL CHEMISTRY—4 cr. (3 and 3)

\*Chem 402—INORGANIC CHEMISTRY—3 cr. (3 and 0)

Chem 411—INSTRUMENTAL ANALYSIS—3 cr. (1 and 6)

Chem 421—QUALITATIVE ORGANIC ANALYSIS—3 cr. (1 and 6)

Chem 423—GENERAL BIOCHEMISTRY—3 cr. (3 and 0)

Chem 424—GENERAL BIOCHEMISTRY—3 cr. (3 and 0)

Chem 454—INORGANIC SYNTHESIS—2 cr. (0 and 6)

Chem 472—ORGANIC SYNTHESIS—3 cr. (1 and 6)

Chem 491—INTRODUCTION TO RADIOCHEMISTRY—3 cr. (2 and 3)

Chem 503—INORGANIC CHEMISTRY—3 cr. (3 and 0)

A comprehensive review of the field of inorganic chemistry.

Chem 505—ADVANCED INORGANIC CHEMISTRY—3 cr. (3 and 0)

A study of atomic crystal and molecular structure and its relationship to inorganic chemistry. **Prerequisite:** Chem 402 or 503.

Chem 511—ADVANCED ANALYTICAL CHEMISTRY—3 cr. (3 and 0)

This course includes error analysis, the elementary statistical theory involved in procedures, and design of experiments and certain industrial control methods. Selected methods for the determination of a few elements not covered in the elementary courses are discussed as well as the less commonly used physio-chemical methods. **Prerequisites:** Chem 331 and 332 or 530 and 531.

Chem 512—CHEMICAL SPECTROSCOPIC METHODS—3 cr. (2 and 3)

This course is designed to give the student an understanding of the principles of spectroscopic procedures. Both absorption and emission techniques will be considered. Emphasis will be placed on ultraviolet and infrared as well as visible spectra.

Chem 520—INTERMEDIATE ORGANIC CHEMISTRY—3 cr. (3 and 0)

A comprehensive review of the field of organic chemistry.

Chem 521—ADVANCED ORGANIC CHEMISTRY—3 cr. (3 and 0)

The object of this course is to give a general survey of organic chemistry with special attention given to the general types of organic reactions and to important processes. The lectures are supplemented by assigned problems and reports on current organic literature which are discussed during a weekly conference. **Prerequisite:** Chem 520.

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\*Courses which may be used for a minor in chemistry by students majoring in other fields.



**Chem 530—PHYSICAL CHEMISTRY—3 cr. (3 and 0)**

A comprehensive review of the field of physical chemistry. The student will also be required to take laboratory work if he has not been sufficiently well grounded previously in this phase of the subject. **Prerequisites:** Coourses in qualitative analyses, organic chemistry, and a working knowledge of integral calculus.

**Chem 531—PHYSICAL CHEMISTRY—3 cr. (3 and 0)**

A continuation of Chem 530.

**Chem 532—ADVANCED PHYSICAL CHEMISTRY—3 cr. (3 and 0)**

An advanced course covering special phases of physical chemistry such as recent advances in the theory of solutions, chemical kinetics, catalysis and phase equilibrium. **Prerequisites:** Chem 530 and 531.

**Chem 541—ATOMIC AND MOLECULAR STRUCTURE—3 cr. (3 and 0)**

The purpose of this course is to strengthen the student's understanding of atomic structure and to extend his knowledge of the structure of molecules. Major emphasis will be given to studying the relationship of structure to physical and chemical properties with examples drawn from both the organic and inorganic fields.

**Chem 542—ADVANCED RADIOCHEMISTRY—3 cr. (3 and 0)**

A study of the properties of atomic nuclei, types of radioactive decay, interaction of radiation with matter and the applications of radioisotopes in research. **Prerequisites:** Chem 491.

**Chem 591—RESEARCH—3 cr.****Chem 592—RESEARCH—3 cr.****CIVIL ENGINEERING**

**W. L. Lowry, Jr., Chairman**

**Courses are offered leading to the Master of Science degree.**

**CE 305—ROUTE SURVEYING—3 cr. (2 and 3)****CE 307—ROADS AND PAVEMENTS—3 cr. (2 and 3)****CE 309—TRUSSES—1 cr. (0 and 3)****CE 310—STRUCTURES—3 cr. (2 and 3)****CE 317—MATERIALS AND METHODS OF CONSTRUCTION—2 cr.  
(2 and 0)****CE 401—STRUCTURAL DESIGN—3 cr. (2 and 3)****CE 402—STRUCTURAL ANALYSIS—2 cr. (2 and 0)****CE 409—REINFORCED CONCRETE STRUCTURES—3 cr. (2 and 3)**

CE 410—MUNICIPAL AND SANITARY ENGINEERING—3 cr. (2 and 3)

CE 412—REINFORCED CONCRETE DESIGN—2 cr. (1 and 3)

CE 414—SOIL MECHANICS—3 cr. (2 and 3)

CE 417—CITY PLANNING—2 cr. (2 and 0)

CE 452—ADVANCED STRUCTURAL ANALYSIS—2 cr. (2 and 0)

CE 501—ADVANCED STRUCTURAL ENGINEERING—3 cr. (2 and 3)

Analysis of statistically indeterminate structures including secondary stresses and rigid frames.

CE 502—ADVANCED STRUCTURAL ENGINEERING—3 cr. (2 and 3)

A continuation of CE 501.

CE 503—MODEL ANALYSIS—3 cr. (2 and 3)

Methods of determining moments and stresses from a study of models; principles of similitude; use of the Beggs deformer.

CE 510—HIGHWAY SAFETY AND TRAFFIC CONTROL—3 cr. or 2 cr. (3 and 0) or (2 and 0)

Study of highway safety principles affecting the design of city streets and rural highways, devices for controlling highway traffic and related subjects, and design of traffic signal systems. **Prerequisite:** CE 307.

CE 511—HIGHWAY DESIGN—3 cr. (2 and 3)

Studies of economics of highway grades, location, alignment with road surfaces and factors that control highway planning. **Prerequisite:** CE 307.

CE 519—HIGHWAY RESEARCH—2 to 4 cr.

Independent investigation of some problems in highway engineering.

CE 520—CONCRETE MIXES AND MATERIALS—3 cr. (2 and 3)

Properties and factors controlling properties of concrete: investigation and selection of materials; mixes and design of mixes; inspection, field laboratory facilities and reports; concrete manufacture; handling, placing and curing; special types; sonic method of testing. **Prerequisite:** CE 409.

CE 531—SOIL ENGINEERING—3 cr. (2 and 3)

Shearing resistance consolidation, settlement, displacement and compaction, pile supporting strength, application of principles to earthwork, foundations and highway problems. **Prerequisite:** CE 414.

CE 591—RESEARCH—3 cr.

CE 592—RESEARCH—3 cr.

## DAIRY

B. E. Goodale, Chairman

Courses are offered leading to the Master of Science degree.

Dairy 306—MARKET MILK—3 cr. (2 and 3)



Dairy 352—ADVERTISING AND MARKETING—3 cr. (3 and 0)

Dairy 354—ENDOCRINOLOGY—3 cr. (3 and 0)

Dairy 401—DAIRY PLANT MANAGEMENT—3 cr. (2 and 3)

Dairy 402—DAIRY MANUFACTURES—4 cr. (3 and 3)

Dairy 403—ANIMAL NUTRITION—3 cr. (3 and 0)

Dairy 452—DAIRY CATTLE FEEDING AND MANAGEMENT—3 cr.  
(2 and 3)

Dairy 501—TOPICAL PROBLEMS—1 to 3 cr.

Topics of interest to the graduate students. The course is designed to give experience with problems in dairying not covered by thesis research. Credit varies with the problems selected.

Dairy 502—GENETICS OF DAIRY CATTLE IMPROVEMENT—3 cr.  
(3 and 0)

A study of the inheritance in dairy cattle, with emphasis on milk and butterfat production, methods used in proving sires and dams and in analyzing herds as aids to selection.

Dairy 503—PHYSIOLOGY OF REPRODUCTION AND MILK SECRETION  
—3 cr. (3 and 0)

The influence of the endocrine glands on reproduction and on milk secretion.

Dairy 505—NEWER KNOWLEDGE OF ANIMAL NUTRITION—3 cr.  
(3 and 0)

The application of the latest information on digestion, metabolism, and the nutritional requirements of animals.

Dairy 507—FERMENTED DAIRY PRODUCTS—3 cr. (2 and 3)

The biological and chemical changes involved in the processing and aging of cheese, Yoghurt and other fermented dairy products.

Dairy 508—INDUSTRIAL DAIRY SCIENCE—3 cr. (3 and 0)

Provides advanced technological training in dairy plant processing and manufacturing.

Dairy 591—RESEARCH—3 cr.

Dairy 592—RESEARCH—3 cr.

## DRAWING AND DESIGNING

D. W. Bradbury, Chairman

The department does not award advanced degrees. Courses are offered to provide minor field specialization.

DD 401—FUNDAMENTALS OF MACHINE DESIGN—3 cr. (3 and 0)

DD 402—THE DESIGN OF MACHINE ELEMENTS—3 cr. (2 and 3)

DD 464—LUBRICATION—2 cr. (2 and 0)

DD 501—DESIGN PROBLEMS IN VIBRATIONS AND DYNAMICS—3 cr.  
(3 and 0)

The application of vibration theory and dynamics to the design of machinery, critical speeds and inertia disturbances, equivalent systems, non-linear systems, isolators, damping devices and vibration instruments. **Prerequisite:** Math 455 or approval of instructor.

DD 502—PLASTICITY—3 cr. (2 and 3)

A study of the behavior of metal machine elements in the plastic region. Development of current theories of failure and application of these to problems involving tension, compression, torsion, bending, and various combinations. **Prerequisite:** Math 306.

DD 503—PHOTOELASTICITY—3 cr. (2 and 3)

Development of fundamental relations, study of the polariscope, stress distribution, and short unsolved problems.

## ECONOMICS AND INDUSTRIAL MANAGEMENT

C. L. Epting, Chairman (Econ)

W. D. Trevillian, Chairman (IM)

Advanced degrees are not awarded in these areas. Courses are offered to provide minor field specialization. To be eligible to obtain graduate credit in Economics or Industrial Management the student must have earned at least twelve semester hours credit of undergraduate work in these disciplines.

Econ 403—DEVELOPMENT OF ECONOMIC THOUGHT—3 cr. (3 and 0)

Econ 412—INTERNATIONAL TRADE—3 cr. (3 and 0)

IM 402—PRODUCTION PLANNING AND CONTROL—3 cr. (3 and 0)

IM 404—INDUSTRIAL ECONOMICS—3 cr. (3 and 0)



**EDUCATION**

H. L. Hunter, Chairman (M. S. Program)

J. H. Hobson, Chairman (M. Ed. Program)

Courses are offered leading to the Master of Science degree in Secondary Education and the Master of Education degree in the teaching of the natural sciences.

The following courses are applicable to the Master of Science degree in Secondary Education; and may be credited toward an Education minor:

Ed 494—SCHOOL AND COMMUNITY RELATIONSHIPS—3 cr. (3 and 0)

Ed 497—AUDIO VISUAL AIDS IN EDUCATION—3 cr. (3 and 0)

Ed 503—ADVANCED METHODS IN TEACHING—3 cr. (3 and 0)

The principles and practices involved in promoting effective learning are developed in this course which is planned primarily to assist experienced teachers.

Ed 505—OCCUPATIONAL GUIDANCE AND PLACEMENT—3 cr. (3 and 0)

The organization and administration of a guidance program for public schools. An analysis is made of procedures and techniques used in guidance. Data are collected on placement activities and follow-up work. (This is the basic course in guidance which is required in South Carolina for certification as a counselor in a high school.)

Ed 506—HISTORY AND PHILOSOPHY OF EDUCATION—3 cr. (3 and 0)

The development of education, with emphasis being placed upon development in the United States. Education policies and practices and newer philosophy of American education are given detailed attention.

Ed 508—EDUCATIONAL TESTS AND MEASUREMENTS—3 cr. (3 and 0)

A study of improved methods and techniques which are used in the measurement of intelligence, special aptitudes, and achievement. A survey is made of standardized tests, the sources from which they may be secured and the purposes which they may serve in classification and/or instruction of students. Emphasis is given to the construction of informal tests of achievement, and to the administration and interpretation of standardized tests. (This is one of the five courses which are required in South Carolina for certification as a counselor in a high school.)

Ed 509—ANALYSIS OF THE INDIVIDUAL—3 cr. (3 and 0)

Emphasis is placed on the study and use of techniques of discovering the characteristics of individuals. Training experiences are provided in securing, recording, and interpreting significant data as they relate to counseling. (This is one of the five courses which are required in South Carolina for certification as a counselor in a high school.) **Prerequisite:** Eighteen semester credits in undergraduate and/or graduate professional education, or two years of experience in teaching.

Ed 510—TECHNIQUES OF COUNSELING—3 cr. (3 and 0)

This course is designed to assist graduate students in developing com-

petencies which are needed when dealing with the problems of individuals in counseling situations. Emphasis is placed upon these major objectives in interviewing: (a) securing information, (b) furnishing information, and (c) helping counselors to interpret information in making acceptable decisions. (This is one of the five courses which are required in South Carolina for certification as a counselor in a high school.) **Prerequisites:** Completion of six credits from Ed 505, 508, 509 or 513.

**Ed 511—PUBLIC SCHOOL ADMINISTRATION (Finance)—3 cr. (3 and 0)**

A study of sound principles and suitable procedures relating to school administration and finance.

**Ed 513—EDUCATIONAL AND OCCUPATIONAL INFORMATION—3 cr. (3 and 0)**

An examination and evaluation is made of techniques for collecting, filing, interpreting, and using occupational information in counseling. Practice in the use of these techniques is emphasized. Community surveys and follow-up studies are considered as means of securing pertinent information. (This is one of the five courses which are required in South Carolina for certification as a counselor in a high school.)

**Ed 521—ADULT EDUCATION DEVELOPMENT AND ADMINISTRATION —3 cr. (3 and 0)**

An analysis of the adult education movement and its influence on trade and industrial workers; the applicability of education practices to industrial training problems; and major fields of training in industry.

**Ed 530—TECHNIQUES OF SUPERVISION — THE PUBLIC SCHOOLS—3 cr. (3 and 0)**

This course is designed for teachers, supervisors, and administrators who are interested in improving, coordinating, and evaluating instruction. Modern trends of supervisory practices will be emphasized.

**Ed 531—PUBLIC SCHOOL EVALUATION—3 cr. (3 and 0)**

To determine the effectiveness of a school program its work should be measured by recognized educational criteria. The regional accrediting agencies have developed gauges and devices which are worthwhile instruments when used by competent educators. Total personal growth, subject matter progress, and physical facilities should be evaluated in terms of desirable standards. Development of total long-term plans should be carefully evaluated against community needs. The objectives of this course include those mentioned above and problems presented by members of the class.

**Ed 591—RESEARCH—3 cr.**

**Ed 594—RESEARCH—3 cr.**

The following courses are applicable to the Master of Education degree:

**Chem 450T—A REVIEW OF GENERAL CHEMISTRY I—3 cr. (3 and 0)**



Chem 550T—A REVIEW OF GENERAL CHEMISTRY II—3 cr. (2 and 3)

The lecture portion of this course deals with recent advances in the field of chemistry. Special selected topics will be considered with some emphasis being placed on those of current interest. The laboratory time will be devoted to the study of effective methods of presenting laboratory material.

Geol 450T—EARTH SCIENCE I—3 cr. (2 and 3)

Geol 550T—EARTH SCIENCE II—3 cr. (2 and 3)

A course devoted to mineralogy, petrology and economic geology. The main objectives are: (1) to recognize a number of common minerals; (2) to practice procedures for the identification of unknown materials; (3) to study the occurrence of mineral deposits and their economic aspects, as well as some details of the genesis, classification, and field identification of rocks.

Math 450T—MATHEMATICS IN THE ELEMENTARY SCHOOL—3 cr.  
(3 and 0)

Math 551T—FUNDAMENTAL IDEAS IN SECONDARY MATH I—3 cr.  
(3 and 0)

A development of basic concepts in mathematics, designed to provide a suitable mathematical background for teachers of secondary school mathematics. The material is presented by first considering a few of its historical connections, then descriptive material about it, followed by numerous illustrations of how it enters into the work of the world and development of methods of solutions. The course starts with the simplest concept and ends with trigonometry.

Math 552T—FUNDAMENTAL IDEAS IN SECONDARY MATH II—3 cr.  
(3 and 0)

A continuation of Math 551T. Topics include material from the following: trigonometry, logarithms, series, mathematics of finance, probability, analytic geometry, statistics and calculus.

Math 560T—TEACHING SECONDARY MATHEMATICS—3 cr. (3 and 0)

A study of the problems in classroom instruction as related to arithmetic in the secondary school, algebra, geometry, trigonometry, and calculus. Also considered are the place and function of mathematics in secondary education.

Phys 460T—MODERN PHYSICS FOR HIGH SCHOOL TEACHERS—3 cr.  
(3 and 0)

Phys 501T—PHYSICS FOR HIGH SCHOOL TEACHERS I—3 cr. (3 and 0)

An elementary treatment of mechanics, heat and sound from a mature viewpoint. Material will be chosen to show the growth of ideas and the development of the general laws. Applications to atomic Physics as well as to large scale problems will be studied.

Phys 502T—PHYSICS FOR HIGH SCHOOL TEACHERS II—3 cr. (3 and 0)

A continuation of Physics 501T covering electricity and magnetism, optics, and an introduction to atomic and nuclear physics.

The following courses are normally offered during the Summer Sessions as a service to elementary school teachers. As a rule the courses are not applicable to a graduate degree at Clemson:

Ed 460—CURRICULUM DEVELOPMENT IN THE ELEMENTARY SCHOOL—3 cr. (3 and 0)

Ed 518—ORGANIZATION AND ADMINISTRATION OF ELEMENTARY SCHOOL—3 cr. (3 and 0)

This course is an approach to the organization of the elementary school in terms of improved situations for students, teachers, and administrators. It deals with problems of curriculum design and implementation in terms of needs of modern society and the resultant implication for curriculum development. The course includes comprehensive discussion of the duties and responsibilities of the elementary principal in improving educational opportunities.

## ELECTRICAL ENGINEERING

**J. N. Thurston, Chairman**

**Courses are offered leading to the Master of Science degree.**

EE 312—ELECTRICAL MACHINERY I—3 cr. (3 and 0)

EE 313—BASIC ELECTRICAL MEASUREMENTS—2 cr. (2 and 0)

EE 314—ELECTRICAL MACHINERY I LABORATORY—1 cr. (0 and 3)

EE 315—ALTERNATING-CURRENT CIRCUITS—4 cr. (3 and 3)

EE 316—ALTERNATING-CURRENT CIRCUITS—3 cr. (3 and 0)

EE 317—MEASUREMENTS LABORATORY—1 cr. (0 and 3)

EE 320—ELECTRONICS I—3 cr. (3 and 0)

EE 321—PRINCIPLES OF ILLUMINATION—3 cr. (3 and 0)

EE 322—ELECTRONICS I LABORATORY—1 cr. (0 and 3)

EE 402—ENGINEERING ANALYSIS—1 cr. (0 and 3)

EE 407—ELECTRONICS II—3 cr. (3 and 0)

EE 409—ELECTRONICS II LABORATORY—1 cr. (0 and 3)

EE 410—TRANSIENTS AND SERVOMECHANISMS—3 cr. (3 and 0)

EE 415—ADVANCED CIRCUITS—3 cr. (3 and 0)

EE 417—ELECTRICAL MACHINERY II—3 cr. (3 and 0)

EE 419—ELECTRICAL MACHINERY II LABORATORY—1 cr. (0 and 3)



EE 431—RADIO COMMUNICATION—3 cr. (3 and 0)

EE 433—RADIO COMMUNICATION LABORATORY—1 cr. (0 and 3)

EE 434—INDUSTRIAL ELECTRONICS—2 cr. (2 and 0)

EE 436—RADIATION AND WAVE PROPAGATION—3 cr. (3 and 0)

EE 438—INDUSTRIAL ELECTRONICS LABORATORY—1 cr.  
(0 and 3)

EE 501—TRANSIENTS IN LINEAR SYSTEMS—3 cr. (3 and 0)

A study of linear electrical and mechanical systems using the Laplace transformation to determine transient as well as steady-state response.

EE 510—CLOSED-LOOP CONTROL SYSTEMS—3 cr. (3 and 0)

The application of Laplace transform methods as well as transfer-function analysis to the study of regulators, servomechanisms, and other automatic control systems.

EE 511—ELECTRIC POWER STATIONS—3 cr. (3 and 0)

A comprehensive study of station lay-out, generating equipment, exciters, transformers, meters, switching and protective devices. Economical arrangement and operation are emphasized.

EE 521—RADIATION AND WAVE PROPAGATION—3 cr. (3 and 0)

An advanced study of electric fields, vector analysis, Maxwell's equations and their use in the study of wave guides, radiation and wave propagation.

EE 525—TRANSISTOR THEORY AND APPLICATIONS—3 cr. (3 and 0)

EE 530—PULSE TECHNIQUES—4 cr. (3 and 3)

Analysis of basic circuits applicable to pulse-modulation communication systems, computers, high-speed time measurements, and cathode-ray instrumentation. Principles involved in electronic instruments for nuclear measurements, nuclear reactor control, and other applications involving pulsed electrical energy.

EE 591—RESEARCH—3 cr.

EE 592—RESEARCH—3 cr.

## ENGINEERING MECHANICS

R. W. Moorman, Chairman

**Courses are offered leading to the Master of Science degree.**

Mech 401—FLUID MECHANICS—3 cr. (3 and 0)

Mech 403—FLUID MECHANICS LABORATORY—1 cr. (0 and 3)

Mech 450—MECHANICAL VIBRATIONS—3 cr. (3 and 0)

Mech 460—HYDROLOGY—2 or 3 cr. (2 or 3 and 0)

Mech 462—WATER POWER ENGINEERING—2 or 3 cr. (2 or 3 and 0)

Mech 464—FLOW IN OPEN CHANNELS—2 or 3 cr. (2 or 3 and 0)

Mech 502—SPECIAL TOPICS IN MECHANICS OF MATERIALS—3 cr.  
(3 and 0)

A study of the general state of stress, strain-energy methods, theories of failure, indeterminate problems in bending, curved bars, dynamic stresses, plates and problems of elastic stability. **Prerequisite:** Mech 304.

Mech 504—DYNAMICS—3 cr. (3 and 0)

A development of more advanced methods of analysis of problems in dynamics with emphasis on practical solutions. Topics are systems with variable mass and variable forces, shaking forces, balancing, vibration, gyroscopes and models. **Prerequisite:** Mech 303.

Mech 506—FLUID MECHANICS—3 cr. (3 and 0)

A comprehensive study of the principles of fluid flow and the application of the principles to practical engineering problems. Among the topics considered are fluid velocity and acceleration, significance of the flow net, pressure distributions, viscosity, surface tension, compressibility, boundary layer and circulation and magnus effect. **Prerequisite:** Mech 401.

Mech 508—FLOOD CONTROL—3 cr. (3 and 0)

A study of the hydrology of floods and the engineering considerations relating to their control. Topics considered in the scope of control measures are economic justification, types of control structures, and survey of flood control measures on major streams in the U. S. **Prerequisites:** Mech 460.

Mech 510—ADVANCED HYDROLOGY—2 cr. (2 and 0)

Special work to strengthen the student's background in modern methods. The technical literature is used extensively for the latest developments. Emphasis is laid on evaporation, infiltration and the synthetic hydrograph. **Prerequisite:** Mech 460.

Mech 512—HYDRAULIC PROJECTS—3 cr. (3 and 0)

This course is devoted to the detailed investigation of engineering problems in hydraulics and related fields. Application of theoretical principles developed in previous courses is emphasized. Subjects include: Spillway and stilling basin; reservoirs; inverted siphons. **Prerequisites:** Mech 460, 464; must be accompanied or preceded by Mech 506.

Mech 591—RESEARCH—3 cr.

Mech 592—RESEARCH—3 cr.

## ENGLISH

H. M. Cox, Chairman

The department does not award advanced degrees. Courses are offered to provide minor field specialization. Students who expect graduate credit in English should present at least six semester hours of undergraduate credit in English or American Literature above the sophomore level.



- Engl 405—SHAKESPEARE—3 cr. (3 and 0)  
Engl 406—SHAKESPEARE—3 cr. (3 and 0)  
Engl 409—CHAUCER—3 cr. (3 and 0)  
Engl 423—A SURVEY OF AMERICAN LITERATURE—3 cr. (3 and 0)  
Engl 424—A SURVEY OF AMERICAN LITERATURE—3 cr. (3 and 0)  
Engl 425—THE ROMANTICS—3 cr. (3 and 0)  
Engl 427—VICTORIAN LITERATURE—3 cr. (3 and 0)  
Engl 431—RESTORATION AND EIGHTEENTH CENTURY—3 cr. (3 and 0)  
Engl 433—CONTEMPORARY BRITISH LITERATURE—3 cr. (3 and 0)  
Engl 434—CONTEMPORARY AMERICAN LITERATURE—3 cr. (3 and 0)  
Engl 435—SOUTHERN LITERATURE—3 cr. (3 and 0)

### ENTOMOLOGY

J. H. Cochran, Chairman

Courses are offered leading to the Master of Science and Doctor of Philosophy degrees.

- Ent 305—ECONOMIC ENTOMOLOGY—3 cr. (2 and 3)  
Ent 306—ECONOMIC ENTOMOLOGY—3 cr. (2 and 3)  
Ent 405—INSECT MORPHOLOGY—3 cr. (2 and 3)  
Ent 408—GENERAL AND TAXONOMIC ENTOMOLOGY—5 cr. (3 and 6)  
Ent 468—INTRODUCTION TO RESEARCH—2 cr. (1 and 3)  
Ent 505—ADVANCED MORPHOLOGY—3 cr. (2 and 3)  
Principles of insect morphology with the detailed morphology of a taxonomic group. **Prerequisite:** Ent 405.  
Ent 552—ADVANCED SYSTEMATIC ENTOMOLOGY—2 cr. (0 and 6)  
A survey of taxonomic literature with a detailed study of a selected taxonomic group. **Prerequisite:** Ent 408.  
Ent 556—MEDICAL ENTOMOLOGY—3 cr. (2 and 3)  
Disease vectors of animals with emphasis on insects and related Arthropod disease carriers. **Prerequisite:** Ent 301.  
Ent 561—INSECT TOXICOLOGY—3 cr. (2 and 3)  
History, development, application, chemical nature and mode of action of insects. **Prerequisites:** Chem 220 and Ent 405.  
Ent 562—INSECT PHYSIOLOGY—3 cr. (2 and 3)  
The physiology of nutrition, digestion, respiration, excretion, nervous and hormonal systems. **Prerequisites:** Chem 220 and Ent 405.

**Ent 563—SPECIAL PROBLEMS IN ENTOMOLOGY—3-6 cr.**

Original investigation of special problems in entomology not related to a thesis but designed to provide experience and training in research. Emphasis will be placed on insect toxicology, insect physiology, medical entomology and biological control of insects.

**Ent 590—RESEARCH TECHNIQUES IN AGRICULTURE—3 cr. (2 and 3)**

This course is designed to give the student a comprehensive understanding of research procedures and techniques in solving problems in the various fields of agriculture. Special attention will be given to the design of experiments, interpretation of results and report writing. The student will be expected to prepare a written report on a selected problem.

**Ent 591—RESEARCH—3 cr.****Ent 592—RESEARCH—3 cr.****HISTORY AND GOVERNMENT**

**C. L. Epting, Chairman**

The department does not award advanced degrees. Courses are offered to provide minor field specialization. To be eligible for graduate credit in History and Government the student should present at least twelve semester hours of undergraduate work in this field.

**Gov 401—COMPARATIVE GOVERNMENT—3 cr. (3 and 0)****Hist 401—HISTORY OF SOUTH CAROLINA—3 cr. (3 and 0)****Hist 403—HISTORY OF THE SOUTH TO 1865—3 cr. (3 and 0)****Hist 404—HISTORY OF THE SOUTH SINCE 1865—3 cr. (3 and 0)****Hist 405—THE AMERICAN FRONTIER—3 cr. (3 and 0)****Hist 406—HISTORY OF MANUFACTURING IN THE UNITED STATES—  
3 cr. (3 and 0)****Hist 407—DIPLOMATIC HISTORY OF THE UNITED STATES—3 cr.  
(3 and 0)****Hist 408—EUROPE SINCE 1914—3 cr. (3 and 0)****Hist 409—INTRODUCTION TO HISTORICAL RESEARCH—2 cr. (1 and 3)****Hist 501—SEMINAR IN SOUTH CAROLINA HISTORY—3 cr. (3 and 0)****HORTICULTURE**

**T. B. Hagler, Chairman**

**Courses are offered leading to the Master of Science degree.**

**Hort 302—PRINCIPLES OF VEGETABLE PRODUCTION—3 cr. (2 and 3)**



Hort 310—FLORICULTURE—3 cr. (2 and 3)

Hort 352—COMMERCIAL POMOLOGY—3 cr. (2 and 3)

Hort 402—GARDEN DESIGN—3 cr. (2 and 3)

Hort 405—NUT CULTURE AND SPRAYS—3 cr. (2 and 3)

Hort 407—LANDSCAPE DESIGN—3 cr. (2 and 3)

Hort 451—SYSTEMATIC POMOLOGY AND SMALL FRUIT CULTURE—  
3 cr. (2 and 3)

Hort 456—TRUCK CROPS—3 cr. (2 and 3)

Hort 460—ADVANCED LANDSCAPE DESIGN—5 cr. (3 and 6)

Hort 464—FOOD PRESERVATION—3 cr. (2 and 3)

Hort 468—INTRODUCTION TO RESEARCH—2 cr. (1 and 3)

Hort 501—PROBLEMS IN SMALL FRUIT PRODUCTION—3 cr. (2 and 3)

A study of selected problems encountered in the production of blueberries, strawberries, brambles and grapes. **Prerequisite:** Hort 451.

Hort 503—ADVANCED VEGETABLE CROPS—3 cr. (2 and 3)

A systematic study of sources of information and practices with emphasis on the application and handling of vegetable crops. **Prerequisite:** Hort 456.

Hort 505—FOOD TECHNOLOGY—3 cr. (1 and 6)

This course includes quality control methods and equipment such as special titrations, taste panels, refractometers, succulometers, tenderometers, and colorimeters; the role of sugars, salts, and acids and chemical preservatives in foods; quality grade standards, and special problems. **Prerequisites:** Bact 301, 303, Hort 464.

Hort 507—ADVANCED POMOLOGY—3 cr. (2 and 3)

A study of the growth and development of deciduous fruits with emphasis on the peach and apple. **Prerequisite:** Hort 452.

Hort 591—RESEARCH—3 cr.

Hort 592—RESEARCH—3 cr.

## INDUSTRIAL EDUCATION

J. L. Brock, Chairman

Courses are offered leading to the Master of Science degree.

Ed 421—COORDINATION METHODS IN VOCATIONAL EDUCATION—  
2 cr. (2 and 0)

Ed 446—SHOP PLANNING AND LAYOUT—3 cr. (3 and 0)

Ed 496—PUBLIC AND INDUSTRIAL RELATIONS FOR VOCATIONAL TEACHERS AND SUPERVISORS—3 cr. (3 and 0)

Ed 516—HISTORY AND PHILOSOPHY OF VOCATIONAL EDUCATION—3 cr. (3 and 0)

A comprehensive course including the development of vocational education to the present time, the influence of European vocational programs on the United States, and the Federal Vocational Acts policies. Current problems and trends are discussed.

Ed 521—ADULT EDUCATION DEVELOPMENT AND ADMINISTRATION—3 cr. (3 and 0)

A critical analysis of the adult education movement and its influence on trade and industrial workers; the applicability of education practices to industrial training problems; major fields of training in industry; evaluation of union participation in education programs; psychological approaches to problems in worker-management relations.

Ed 561—ADMINISTRATION AND SUPERVISION OF VOCATIONAL EDUCATION—3 cr. (3 and 0)

The expanding program of vocational education under the George-Barden Act and problems on national, state and local levels are discussed. Major specific problems in unit trade programs, and out-of-school youth, selection and training of teachers, veteran training and others are covered.

Ed 591—INTRODUCTION TO RESEARCH IN EDUCATION—3 cr.

Ed 596—RESEARCH IN INDUSTRIAL EDUCATION—3 cr.

## MATHEMATICS

D. C. Sheldon, Chairman

Courses are offered leading to the Master of Science degree.

Math 302—THEORY OF EQUATIONS—3 cr. (3 and 0)

Math 303—STATISTICS—3 cr. (3 and 0)

Math 304—STATISTICS—3 cr. (3 and 0)

Math 306—ORDINARY DIFFERENTIAL EQUATIONS—3 cr. (3 and 0)

Math 307—ELEMENTARY PARTIAL DIFFERENTIAL EQUATIONS—3 cr.  
(3 and 0)

Math 309—THEORY OF APPROXIMATIONS—3 cr. (3 and 0)

Math 451—VECTOR ANALYSIS—3 cr. (3 and 0)

Math 452—FOURIER SERIES—3 cr. (3 and 0)

Math 453—ADVANCED CALCULUS—3 cr. (3 and 0)

Math 454—ADVANCED CALCULUS—3 cr. (3 and 0)



Math 502—DETERMINANTS AND MATRICES—3 cr. (3 and 0)

Some of the topics included in the course are determinants, polynomials and forms, transformations, system of linear equations.

Math 503—THEORY OF FUNCTIONS OF COMPLEX VARIABLES—3 cr. (3 and 0)

This is a basic course in analysis. The topics include differentiation and integration of analytic functions, power series, residues, contour integration, analytic continuation, and conformal mapping.

Math 504—THEORY OF FUNCTIONS OF COMPLEX VARIABLES—3 cr. (3 and 0)

A continuation of Math 503.

Math 505—NUMERICAL ANALYSIS—3 cr. (3 and 0)

A study of the theory of measurements and errors, properties of the error curve, curve fitting by the method of least squares, use of orthogonal polynomials in curve fitting, methods of the calculus of finite differences.

Math 591—RESEARCH—3 cr.

Math 592—RESEARCH—3 cr.

## MECHANICAL ENGINEERING

J. C. Cook, Jr., Chairman

The department offers courses leading to the Master of Science degree.

IE 402—METALLURGY—3 cr. (2 and 3)

ME 411—GAS POWER—3 cr. (3 and 0)

ME 412—STEAM POWER—3 cr. (3 and 0)

ME 413—MECHANICAL ENGINEERING LABORATORY—1 cr. (0 and 3)

ME 414—MECHANICAL ENGINEERING LABORATORY—1 cr. (0 and 3)

ME 417—ENGINEERING ANALYSIS—1 cr. (0 and 3)

ME 422—PRINCIPLES OF TURBOMACHINERY—3 cr. (3 and 0)

ME 423—INTERNAL COMBUSTION ENGINE ANALYSIS—1 cr. (0 and 3)

ME 429—AIR CONDITIONING—3 cr. (3 and 0)

ME 430—AIR CONDITIONING DESIGN—1 cr. (0 and 3)

ME 433—ELEMENTARY AERODYNAMICS—3 cr. (3 and 0)

ME 434—REFRIGERATION—2 cr. (2 and 0)

ME 501—ADVANCED AIR CONDITIONING—3 cr. (3 and 0)

An analysis of the principles of air conditioning. The following topics are among those covered: enthalpy of air-vapor mixtures; adiabatic mix-

tures of air with water, steam or ice; fogged air; adiabatic saturation; air in contact with water; fundamental simultaneous and fundamental successive conditioning processes; humid air below 32 degrees F., geometry of the psychrometric chart. A critical analysis of current literature on special topics. **Prerequisite:** ME 429.

**ME 510—ADVANCED THERMODYNAMICS—3 cr. (3 and 0)**

This course supplements and extends the material covered in elementary thermodynamics. Special topics relative to advanced problems in engineering are pursued. **Prerequisites:** ME 311, 312, and registration in Math 306.

**ME 511—THERMODYNAMICS OF COMPRESSIBLE FLUID FLOW—3 cr. (3 and 0)**

An application of thermodynamics to the flow of compressible fluids. Topics to be covered include concepts of compressible flow, isentropic flow, normal shock waves, flow in constant area ducts with friction, flow in ducts with heating or cooling, generalized one-dimensional continuous flow, introduction to flow in two and three dimensions, concepts of stream function and velocity potential.

**ME 521—ADVANCED INTERNAL COMBUSTION ENGINES—3 cr. (3 and 0)**

Internal combustion process analysis, deviation from the ideal processes, detonation, and knock testing, carburetion and fuel injection, combustion chamber and cylinder head design, engine cooling, mechanics of principle moving parts, engine vibration and balance and engine design.

**ME 523—ADVANCED INTERNAL COMBUSTION ENGINE LABORATORY—1 cr. (0 and 3)**

Analysis of engine instrumentation, airfuel ratio tests, detonation limited power test, injection and analysis with test apparatus, fuels testing and general test codes.

**ME 524—ADVANCED GAS TURBINES—3 cr. (3 and 0)**

Gas turbine process analysis, deviation from the ideal process, fuels stratification, efficiencies, pressure ratio, including the development of charts for cycle analysis.

**ME 532—ADVANCED HEAT TRANSFER—3 cr. (3 and 0)**

The application of heat transfer to several engineering problems pertaining to the design of heat transfer equipment such as boilers, condensers, evaporators, and air preheaters. **Prerequisites:** ME 308, Math 306.

**ME 591—RESEARCH—3 cr.**

**ME 592—RESEARCH—3 cr.**



**PHYSICS****L. D. Huff, Chairman**

**Courses are offered leading to the Master of Science degree.**

Graduate students majoring in Physics are normally expected to take at least two of the following three courses as a part of their graduate program: Physics 521, 541 and 542. Students majoring in this field are required to demonstrate a reading knowledge of one modern foreign language. It is suggested that these students select a minor in Mathematics, Chemistry or one of the branches of Engineering.

Phys 312—HEAT AND KINETIC THEORY—4 cr. (4 and 0)

Phys 314—EXPERIMENTAL HEAT—1 cr. (0 and 3)

Phys 321—MECHANICS AND PROPERTIES OF MATTER—4 cr. (4 and 0)

Phys 323—EXPERIMENTAL MECHANICS—1 cr. (0 and 3)

Phys 332—GEOMETRIC OPTICS AND INTRODUCTION TO PHYSICAL OPTICS—3 cr. (3 and 0)

Phys 341—ELECTRICITY AND MAGNETISM—3 cr. (3 and 0)

Phys 432—PHYSICAL OPTICS AND INTRODUCTION TO ATOMIC SPECTRA—3 cr. (3 and 0)

Phys 441—ELECTROMAGNETISM—3 cr. (3 and 0)

Phys 443—ELECTRICAL MEASUREMENTS—2 cr. (1 and 3)

Phys 451—MODERN PHYSICS—3 cr. (3 and 0)

Phys 452—INTRODUCTORY NUCLEAR PHYSICS—3 cr. (3 and 0)

Phys 453—EXPERIMENTS IN MODERN PHYSICS—1 cr. (0 and 3)

Phys 454—NUCLEAR PHYSICS LABORATORY—1 cr. (0 and 3)

Phys 511—THERMODYNAMICS—3 cr. (3 and 0)

The laws of the thermodynamics entropy and properties of pure substance, engine cycles, the application of thermodynamics to various systems and applications to chemical systems.

Phys 512—KINETIC THEORY AND STATISTICAL MECHANICS—3 cr. (3 and 0)

A development of the kinetic theory of gases including derivations of relationships between molecular diameters, distribution of velocities, mean free paths, viscosity, thermal conductivity, specific heat, entropy, probability and reaction kinetics. The basic concepts of statistical mechanics for classical and quantum systems will be developed.

**Phys 521—DYNAMICS—3 cr. (3 and 0)**

The more advanced phase of dynamics including the equations of Lagrange and Hamilton, generalized coordinates, oscillatory and cyclic motion and Newtonian potential theory.

**Phys 541—ELECTRODYNAMICS—3 cr. (3 and 0)**

This course starts with Maxwell's equations for electric and magnetic fields and includes consideration of production and propagation of electromagnetic waves, wave optics and theories of interference and diffraction.

**Phys 542—RADIATION THEORY—3 cr. (3 and 0)**

The production and propagation of electromagnetic waves are studied using Maxwell's equations as a starting point. Discussions of wave guides, diffraction phenomenon, and boundary effects are included. An introduction to the theory of electrons and microscopic phenomenon will be given.

**Phys 543—REACTOR THEORY I—3 cr. (3 and 0)**

A brief account of nuclear physics: basic instrumentation; interaction of neutrons with matter; chain reactions; neutron diffusion; flux distribution and critical mass; the bare homogeneous reactor; lattice constants; reactor kinetics.

**Phys 544—REACTOR THEORY II—3 cr (3 and 0)**

Homogeneous reactor with reflector; power reactions; materials of construction; methods of heat removal; reactor control; radiation hazards; shielding.

**Phys 545—SOLID STATE I—3 cr. (3 and 0)**

An introduction to the study of the physical properties of crystalline solids.

**Phys 546—SOLID STATE II—3 cr. (3 and 0)**

A continuation of Physics 545.

**Phys 551—INTRODUCTION TO QUANTUM MECHANICS—3 cr. (3 and 0)**

An introductory course formulating the mathematical physical ideas associated with wave mechanics. Solution of simple physical systems including the hydrogen atom are discussed. **Prerequisites:** Phys 451 and Math 306.

**Phys 552—THEORY OF ATOMIC SPECTRA—3 cr. (3 and 0)**

The excitation of spectra, computation of wave lengths from spectral photographs, the computation of energy levels and the correlation with theories of atomic structure.

**Phys 553—NUCLEONICS—3 cr. (3 and 0)**

This course is designed to give the basic properties of and the experimental methods employed in the study of particles associated with the nucleus. A survey is made of the theories so far advanced for the interaction of these particles and the theories pertaining to the structure of simple nuclei.



Phys 566—RELATIVITY—3 cr. (3 and 0)

This course is intended to give a survey of the special and general theory of relativity including tensor calculus, the Lorentz transformation and three experimental tests of the general theory: (1) planetary motion and the advance of the perihelion of Mercury (2) the bending of light rays in gravitational field and (3) the gravitational shift of spectral lines.

Phys 575—SEMINAR IN CONTEMPORARY PHYSICS—1 or 2 cr. (1 or 2 and 0)

A joint study by graduate students and interested members of the faculty of some area of physics which is currently being extensively investigated.

Phys 591—RESEARCH—3 cr.

Phys 592—RESEARCH—3 cr.

## POULTRY

C. L. Morgan, Chairman

The department does not award advanced degrees. Courses are offered to provide minor field specialization.

PH 352—POULTRY FEEDING AND FLOCK MANAGEMENT—3 cr.  
(2 and 3)

PH 354—POULTRY BREEDING—3 cr. (2 and 3)

PH 355—POULTRY GRADING AND PROCESSING—3 cr. (2 and 3)

PH 457—INCUBATION AND BROODING—3 cr. (2 and 3)

PH 458—POULTRY DISEASES AND PARASITES—3 cr. (2 and 3)

PH 460—SEMINAR—2 cr. (2 and 0)

## SOCIOLOGY

G. H. Aull, Chairman (Rural Sociology)

C. L. Epting, Chairman (General Sociology)

Advanced degrees are not awarded in Sociology. Courses are offered to provide minor field specialization.

RS 454—FARMERS' MOVEMENTS—3 cr. (3 and 0)

RS 459—THE RURAL COMMUNITY—3 cr. (3 and 0)

RS 461—RURAL LEADERSHIP—3 cr. (3 and 0)

RS 501—RURAL SOCIAL SYSTEMS—3 cr. (3 and 0)

A course designed to provide the advanced student with a brief review of the basic working concepts of rural sociology and a knowledge of the basic institutions of rural life and to acquaint the student with the techniques used in applying scientific methods and theory toward understanding the social structure of rural life. **Prerequisites:** Permission of the instructor and 12 hours of social studies, at least three hours of which must be in the field of sociology.

Soc 403—CRIMINOLOGY—3 cr. (3 and 0)

Soc 404—SOCIAL ANTHROPOLOGY—3 cr. (3 and 0)

Soc 405—INDUSTRIAL SOCIOLOGY—3 cr. (3 and 0)

### TEXTILE CHEMISTRY

Joseph Lindsay, Jr., Chairman

Courses are offered leading to the Master of Science degree.

TC 410—COLOR MATCHING AND TESTING—1 cr. (0 and 3)

TC 447—THE CHEMICAL PROCESSING OF TEXTILE MATERIALS—  
3 cr. (3 and 0)

TC 449—TEXTILE CHEMISTRY LABORATORY—1 cr. (0 and 3)

TC 452—THE CHEMICAL PROCESSING OF TEXTILE MATERIALS—  
4 cr. (4 and 0)

TC 454—TEXTILE CHEMISTRY LABORATORY—1 cr. (0 and 3)

TC 455—CELLULOSE CHEMISTRY—3 cr. (3 and 0)

TC 456—CHEMISTRY OF SYNTHETIC FIBERS AND FINISHES—3 cr.  
(3 and 0)

TC 511—THE THEORY AND APPLICATION OF SYNTHETIC RESINOUS  
MATERIALS—3 cr. (2 and 3)

This course gives the student a comprehensive survey of the history, present utility, and probable future expansion of synthetic resins. **Prerequisite:** TC 306 or Chem 222.

TC 512—THE THEORY AND APPLICATION OF SYNTHETIC RESINOUS  
MATERIALS—3 cr. (2 and 3)

A continuation of TC 511.

TC 521—ADVANCED CELLULOSE CHEMISTRY—3 cr. (3 and 0)

This course presents the chemistry of cellulose and closely related polysaccharides, through a systematic study of the extensive volume of research which has been completed on these substances. **Prerequisite:** TC 306 or Chem 324.

TC 531—CHEMISTRY OF COLORING MATTERS—3 cr. (2 and 3)

The work of this course consists of an advanced study of coloring bodies in their major forms, as dyes, pigments and lakes. Their structure and formulation for use is covered in detail with the chief emphasis being placed on the more complex forms, such as the vat colors and insoluble azo compounds. **Prerequisite:** TC 452.



TC 591—RESEARCH—3 cr.

TC 592—RESEARCH—3 cr.

### TEXTILE MANAGEMENT

Gaston Gage, Chairman

The department does not award advanced degrees. Courses are offered to provide minor field specialization.

TM 403—TEXTILE MANAGEMENT—3 cr. (3 and 0)

TM 460—NATURAL FIBERS—3 cr. (3 and 0)

TM 462—TEXTILE MICROSCOPY—2 cr. (1 and 3)

TM 464—PHYSICAL TEXTILE TESTING—2 cr. (1 and 3)

### ZOOLOGY

J. H. Cochran, Chairman

Courses are offered leading to the Master of Science degree.

Zool 301—COMPARATIVE VERTEBRATE ANATOMY—3 cr. (2 and 3)

Zool 302—VERTEBRATE EMBRYOLOGY—3 cr. (2 and 3)

Zool 402—ANIMAL ANATOMY AND PHYSIOLOGY—3 cr. (2 and 3)

Zool 403—PROTOZOOLOGY—3 cr. (2 and 3)

Zool 456—PARASITOLOGY—3 cr. (2 and 3)

Zool 501—ADVANCED ANIMAL HISTOLOGY—3 cr. (2 and 3)

An advanced study in the microscopic structures of the tissues and organs of the animal body and the relation of histology to physiology and pathology. **Prerequisites:** Zool 101, 103, and 402.

Zool 502—HISTOLOGICAL TECHNIQUES—3 cr. (1 and 6)

The fixing, staining, sectioning, and identification of all tissues, glands and organs of animals. **Prerequisites:** Zool 101, 103.

Zool 503—ANIMAL ECOLOGY—4 cr. (2 and 6)

A comprehensive study of animals in relation to their natural environment. Typical animal habitats are visited to study the animal life and the ocean, shore, lakes, streams, swamps, cultivated fields, woodlands, and mountains.

Zool 504—ORNITHOLOGY—3 cr. (2 and 3)

The identification, life history and ecology of birds. Field trips, work with bird specimens and correlated reading will give the student a working knowledge of at least 100 species of the common birds.

Zool 505—PATHOGENIC DISEASE OF LIVESTOCK—3 cr. (3 and 0)

Designed to acquaint the student with the cause, prevention, and treatment of pathogenic diseases.

Zool 556—ECONOMIC ZOOLOGY—3 cr. (2 and 3)

A study of all phylla (exclusive of class insecta) to include those animals either beneficial or destructive to man. **Prerequisites:** Zool 101, 103.

Zool 591—RESEARCH—3 cr.

Zool 592—RESEARCH—3 cr.